Mammo Tomosynthesis

User Guide

BARCO

Visibly yours

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Welcome!

Thank you for choosing this Mammo Tomosynthesis Display!

The Mammo Tomosynthesis Display is specifically designed for the unique requirements of medical imaging, delivering complete and uninterrupted diagnostic confidence and high-bright image quality, helping radiologists to make quick, accurate and confident diagnoses.

The Mammo Tomosynthesis Display supports several advanced features, resulting in the required high performance and diagnostic capabilities. Some of these features are listed below:

- I-LUMINATE ™: one push 'hot light' brightness boost for inspection of subtle details or comparing with film-based priors.
- RAPIDFRAME ™: rapid pixel refreshment, eliminating blurry artifacts and ghosting in multi-frame image sequences.
- ALC: A hemispherical illuminance sensor to control according the ambient light in the room.
- I-Guard: integrated sensor for monitoring and adjusting the luminance, ensuring DICOM P14 compliance.
- QAWeb: automatic Quality Assurance testing and remote assessment of the diagnostic area.
- PPU: Per Pixel Uniformity technology.
- DURALIGHT: superb luminance levels with an exceptionally long life span.
- SMOOTHGREY: ultra-precise grey palette of Just Noticeable Differences.

To use the Mammo Tomosynthesis Display at its full capabilities you should make yourself familiar with these features and how to use them. Features with user interaction are explained in this guide. If you want more information on a specific feature refer to the Barco web site at *http://www.barco.com* or contact the Barco Healthcare Division.

This manual further guides you through the different steps needed to install and use the Mammo Tomosynthesis Display.

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General approach

The Mammo Tomosynthesis Display system exists of two identical displays, mounted side by side on the dedicated system stand or on a custom VESA mount. Throughout the guide, instructions are applicable for both left and right display, unless a difference is specifically stated.

Following symbols may be used throughout this guide:

	Warning: Risk of injury to human beings		Caution: Risk of damage to the product
	Important notice or remark		Note
	Hint, tip		Additional information

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What's in the box

Your MAMMO TOMOSYNTHESIS Display system comes with:

- two displays
- a system tilt and swivel foot
- this MAMMO TOMOSYNTHESIS Display guide
- a system CD
- two DisplayPort cables
- two USB cables
- a set of AC power cords
- two external power supplies
- a keyboard light
- a film clip

For the Barco display controller, refer to the dedicated User Guide.

Keep your original packaging. It is designed for this display and is the ideal protection during transport.

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Parts, controls and connectors

Front view

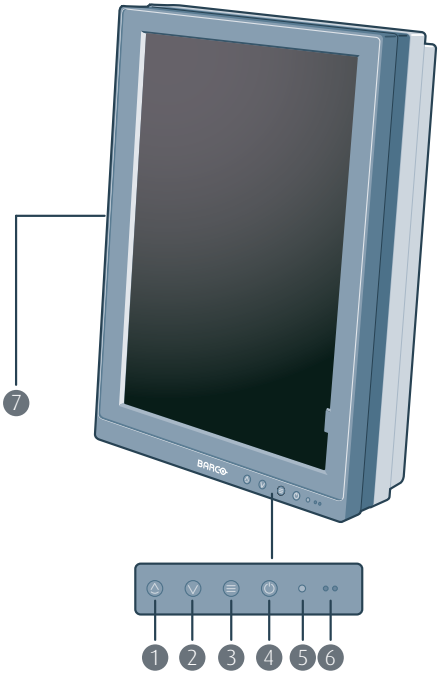

Figure 1: Front view

1. I-Luminate/Left key
2. Right key
3. Menu key
4. Power on/off key
5. Ambient light sensor
6. Power LEDs
7. Side downstream USB 2 & 3

Rear view

Connector compartment cover closed

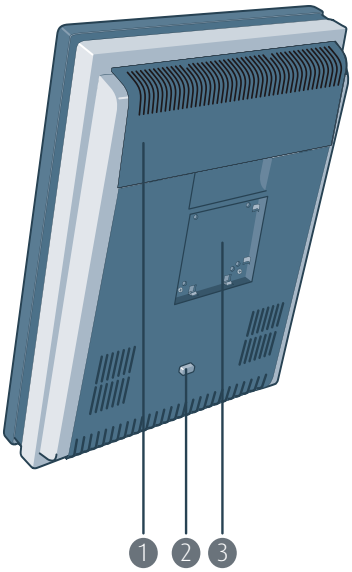

Figure 2: Rear view cover closed

1. Connector compartment cover
2. Display release button
3. Mounting anchor

Connector compartment cover open

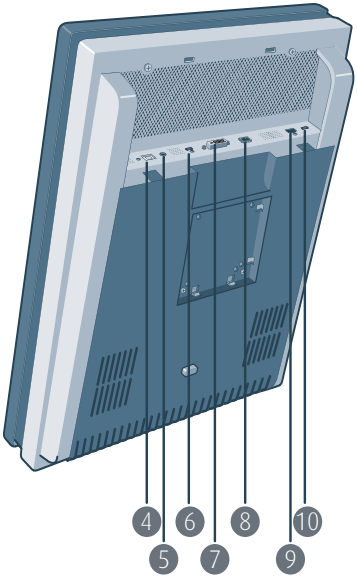

Figure 3: Rear view cover open

4 24 VDC Power input

5 +5 VDC, 0.5 A power output

6 Display Port video input

7 DVI video input

8 Ethernet connection (see note below)

9 USB upstream

10 USB downstream 1

The Ethernet connection is used for maintenance purposes and is not supported for user application.

Dual tilt & swivel foot

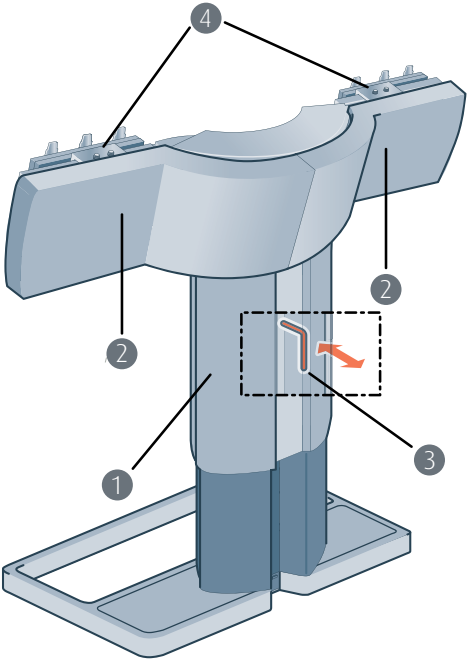

Figure 4:

1. Cable cover
2. Left & right arm cover
3. Foot lock clip (behind cable cover)
4. Display positioning sliders

Accessories

Film clip

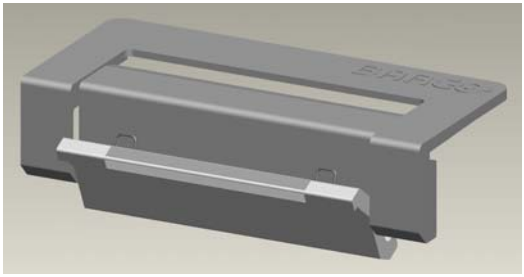

Figure 5: Film clip

The film clip can be used to hold a radiological film when using the I-Luminate function as a light box.

Keyboard light

Figure 6: Keyboard light

The keyboard light can be mounted under the display to provide a workspace light that is not interfering with the display image.

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Setup and installation

Prior to installing your Mammo Tomosynthesis Display system and connecting all cables, make sure to have the display controller physically installed in your computer. Consult the dedicated user guide to do this.

Mounting the displays

Using the dual tilt & swivel foot

1. Unpack the dual tilt & swivel foot and place it on a solid surface.
2. Unpack the first display

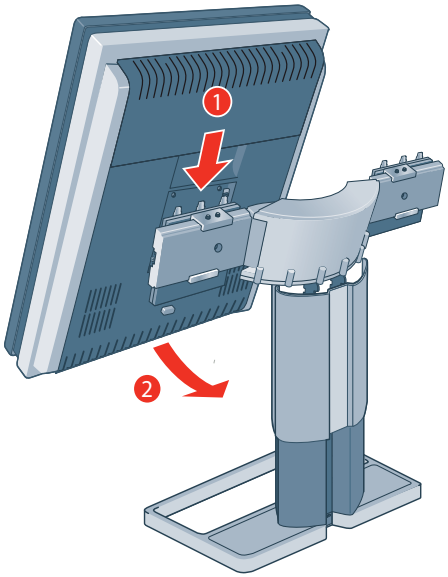


Figure 7: Mounting a display

3. Hold the display slightly angled with the logo downwards and position the top of the mounting anchor, at the back of the display, perfectly aligned on the top of the mounting clamp of the foot.

4 Push the downside of the display gently backwards until the mounting clamp locks into the mounting anchor.

5 Verify that mounting clamp and mounting anchor are perfectly fitting and that the display is firmly mounted.

6 Repeat steps 2 to 5 for the second display.

⚠ Limit transportation distances of the mounted displays and foot system.

7 Pull out the foot lock clip.

8 Retain the clip for possible further transportations.

9 Now that the height-positioning is unlocked, you can adjust the position of the displays.

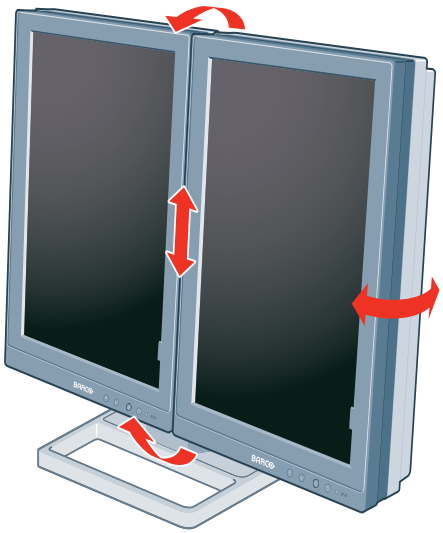


Figure 8: Adjust display position

When both displays are not correctly aligned, minor corrections are possible in relative height and relative angle, by loosening and tightening the opposite pairs of allen screws (opposite sides or opposite diagonals) of the positioning sliders.

Using a VESA mount

The display mounting anchor is compatible with the VESA 100 mm standard.

> ⚠ Use a mounting bracket that can support the weight of the display. Refer to the technical specifications of this display for the applicable weight.

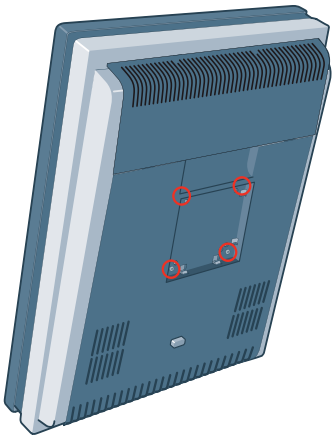


Figure 9: VESA mounting screws

1. Unscrew the four fixation screws in the mounting anchor.
2. Attach the display **firmly** to the VESA mounting bracket with 4 screws M4 x 10 mm. You should mount the display in portrait position. Landscape position is not supported.

Connecting the displays

You may connect the display to a display controller by using the DVI or the DP connection. The active input can be selected in the OSD menu.

Only connect one of the two video links. Connecting both inputs simultaneously will result in driver errors.

1 Remove the cable cover. To remove this cover push the lock clips inside the top of the cover and gently slide the cover upwards on the shaft. It may be needed to tilt the displays if the arm is blocking the movement of the cover.

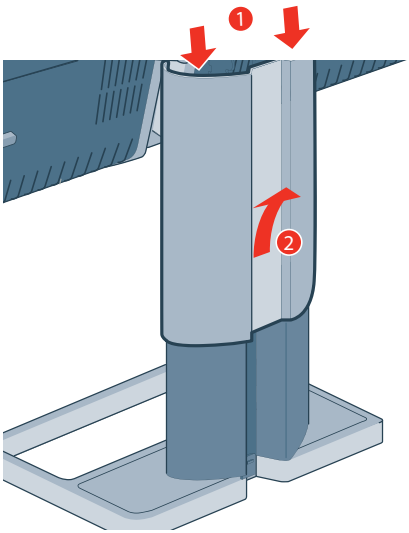


Figure 10: Remove cable cover

2 Remove the connector compartment cover. To remove the cover, gently push the two lips on top of the cover, pull the top of the cover slightly away from the display and lift the cover upwards.

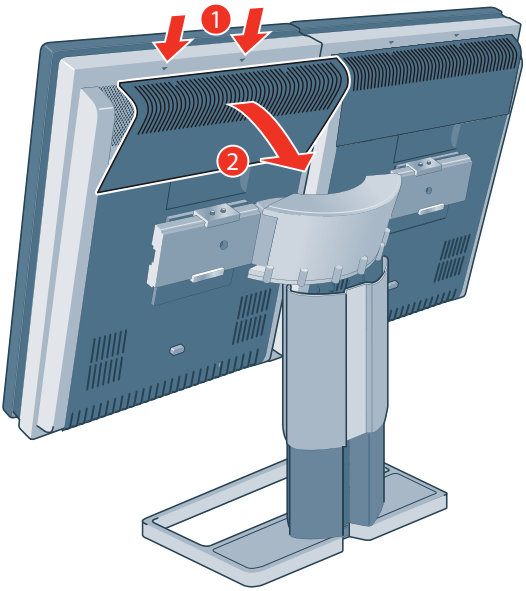


Figure 11: Remove covers

3 Connect the DVI or DP of the display controller to the DVI or DP connector of the display.

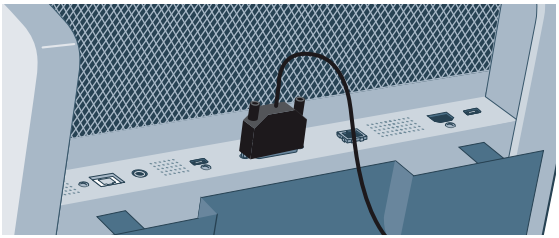


Figure 12: DVI connection

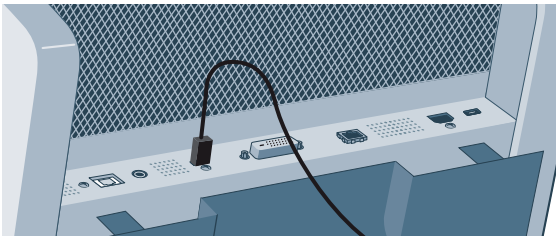


Figure 13: DP connection

4 If you want to make use of the display's USB downstream connectors, connect a PC USB downstream connector to the display's USB upstream connector.

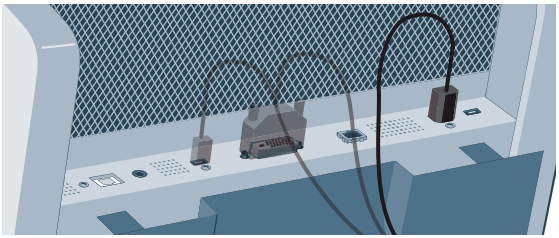


Figure 14: USB connection

5 If you have chosen to use the display's USB downstream connectors, connect a USB device to one of the downstream connectors.

6 Connect the supplied external DC power supply to the +24 VDC power input of the display.

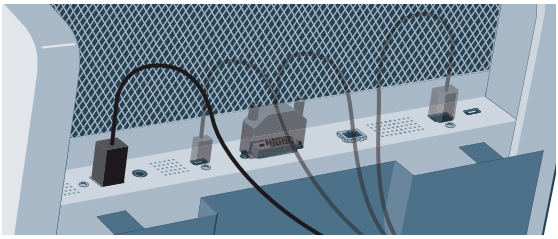


Figure 15: Power connection

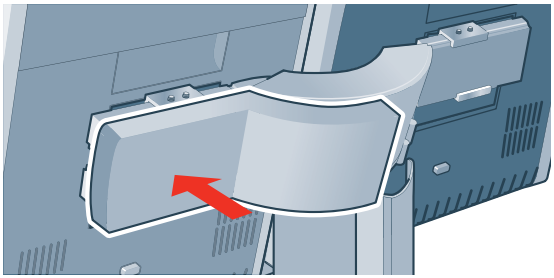
7 Plug the mains connector of the external DC power supply to a grounded power outlet by means of the supplied power cable.

8 Re-attach the connector compartment cover. Position the cover with all four bottom lips in the dedicated spaces on top of the lower back cover. Gently push the top of the cover towards the display while guiding both release lips into the dedicated spaces.

9 Connect the second display as detailed in steps 2 to 8.

10 Re-attach the cable cover by sliding it downwards on the foot shaft. Make sure that the displays are tilted forwards, leaving sufficient space to slide the cover straight down.

11 Attach both arm covers. Position the cover on the arm and gently push it in place.



Routing the cables

If the display is mounted on the system dual tilt & swivel foot, cables are best routed behind the arms and through the cable channel in the foot shaft, as shown in the pictures below.

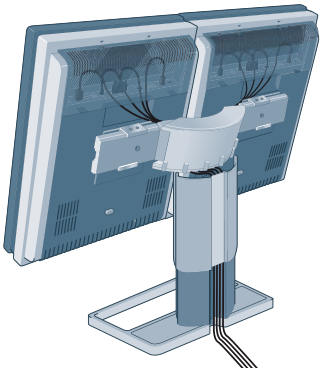


Figure 16: Cable routing

Positioning the displays angled

1. Remove the arm covers.
1. Loosen the allen screws of both the left and right positioning slider.
2. Slide both displays at maximum distance from one another, being carefull not to slide a display off the arm.
3. Rotate the left and right display, by pulling the arm in or out from the center shaft, until they make the required angle. Verify that the cables are still correctly routed and no connection is stressed.
4. Slide both displays to each other, until they are aligned and the brackets are on similar numbers.
5. Fasten the allen screws of both the left and right positioning sliders (minor deficiencies in alignment can be corrected by adjusting the relative depth of opposite screws).
6. Re-attache the arm covers.

Mounting the film clip

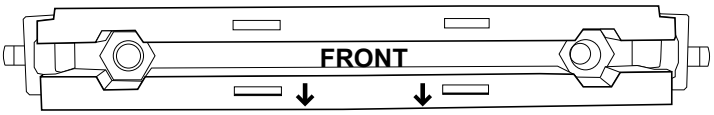
The film clip can be mounted on the top, left or right side of the display.

1. Position the film clip on the bezel at the desired location.
2. Push the clip at the front towards the bezel. The film clip will click in place.
3. Slide the clamp downwards (or sideways) over the screen.

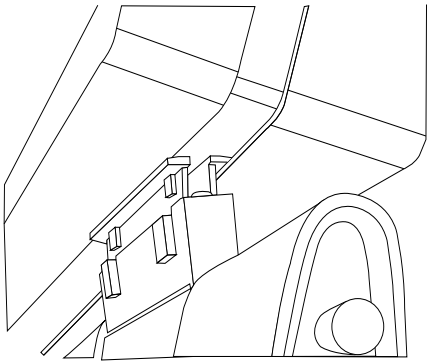
To remove the film clip, lift the rear end of the clip out of the side frame.

Mounting the keyboard light

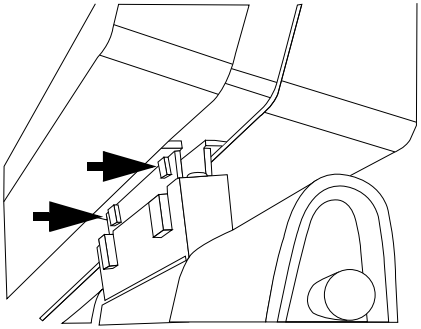
1. The text on the white plastic clip indicates the front side of the keyboard light. This side must be mounted at the front side (image side) of the display.



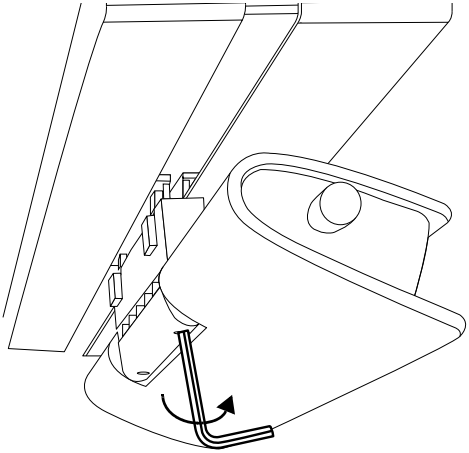
2. Hook the rear part of the white plastic clip in the display bezel gap.



3 Push firmly against the front part of the white plastic clip so that the clip pops into the display bezel gap.

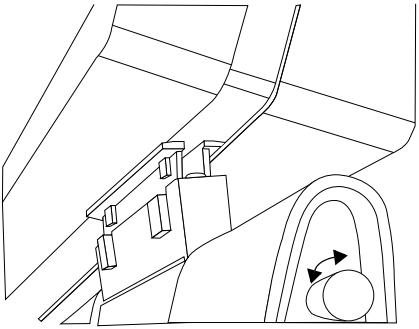


4 With the enclosed Allen key, tighten both screws at the bottom of the keyboard light hinge.



5 Plug the keyboard light mini-jack connector in the display's +5 VDC power output connector.

6 Adjust the light by means of the knob at the side of the keyboard light.



First time starting up

You are now ready to start up your Barco Mammo Tomosynthesis Display System for the first time.

1. Switch on your Mammo Tomosynthesis Display as described in **"Stand-by switching"** on page 31.
2. Turn on the computer connected to your display.

If you have properly installed your display and display controller, the Windows start-up messages will appear once the boot procedure is finished.

Your Mammo Tomosynthesis Display will be running in a basic video mode at a default refresh rate when first time starting up.
If you are using a Barco display controller, please consult the user guide delivered with it to install the drivers, software and documentation. When this is done, your display will automatically detect the connected video input signal(s) and apply the correct video mode and refresh rate.

Daily operation

Recommendations for daily operation

Optimize the lifetime of your display

Enabling the Display Power Management System (DPMS) of your display will optimize its diagnostic lifetime by automatically switching off the backlight when the display is not used for a specified period of time. By default, DPMS is enabled on your display, but it also needs to be activated on your workstation. To do this, go to "Power Options Properties" in the "Control Panel".

Barco recommends setting DPMS activation after 20 minutes of non-usage.

Use a screen saver to avoid image retention

Prolonged operation of an LCD with the same content on the same screen area may result in a form of image retention.

You can avoid or significantly reduce the occurrence of this phenomenon by using a screen saver. You can activate a screen saver in the "Display properties" window of your workstation.

Barco recommends setting screen saver activation after 5 minutes of non-usage. A good screen saver displays moving content.

In case you are working with the same image or an application with static image elements for several hours continuously (so that the screen saver is not activated), change the image content regularly to avoid image retention of the static elements.

Understand pixel technology

LCD displays use technology based on pixels. As a normal tolerance in the manufacturing of the LCD, a limited number of these pixels may remain either dark or permanently lit, without affecting the diagnostic

performance of the product. To ensure optimal product quality, Barco applies strict selection criteria for its LCD panels.

To learn more about LCD technology and missing pixels, consult the dedicated white papers available at www.barco.com/medical.

Enhance user comfort

Every Barco multi-head display system is color matched with the highest specification in the market.

Barco recommends keeping color-matched displays together. Furthermore, it is important to use all displays of a multi-head configuration at the same rate to preserve color matching throughout the economic lifetime of the system.

Maximize quality assurance

The 'MediCal QAWeb' system offers online service for high-grade Quality Assurance, providing maximum diagnostic confidence and uptime.

Learn more and sign up for the free MediCal QAWeb Essential level at www.barco.com/medical/qa

Key LEDs

By default, the , and keys will be dimmed which makes the keys unavailable at that moment. To make the keys illuminate and available for further actions touch one of the not illuminated keys. As a result, the keys will be illuminated and are now available for further actions. However, if no further actions are taken within the following 5 seconds, the keys will dim again.

The key is always lit and available for activation.

The key auto-dim function can be disabled in the OSD menus. Please refer to **"Keys indicator lights"** on page 37 for detailed instructions on how to do this.

Stand-by switching

Switching on the display while it is in stand-by mode or vice versa can both be done by:

1. Illuminate the keys as previously described.
2. While the keys are illuminated, touch the key for approximately 2 seconds.

As a result, the display will switch on or will switch to stand-by mode. When the display is **switched on**, the power LED is **blue**. When the display is in **stand-by mode**, the power LED is **orange**.

The power LED can be disabled in the OSD menus. Please refer to **"Power status indicator light"** on page 36 for detailed instructions on how to do this.

In case of a power outage recovery, your display will always start-up in the power mode it was in before the power interruption (i.e. stand-by or on). This protects your display against inadvertent image retention problems.

I-Luminate

When the display is in power on mode and the OSD menu is not shown, I-Luminate can be activated by touching the key.

I-Luminate supports three modes:

- Full-screen luminance boost.
- Film 18 x 24 mode.
- Film 24 x 30 mode.

For both film modes the position can be set to:

- Left.
- Center.
- Right.

When touching the I-Luminate key, the display will enter the default I-Luminate mode, according to the current setting, for approximately 1 minute.

While activated, the I-Luminate mode can be changed by using the key.

When the display switches back to normal mode, there is no required re-activation time. The boost mode may be activated immediately again.

The default I-Luminate mode can be set in the OSD menu. Please refer to **"I-Luminate default mode"** on page 39 for detailed instructions on how to do this.

The I-Luminate film position can be set in the OSD menu. Please refer to **"I-Luminate film position"** on page 39 for detailed instructions on how to do this.

Rapidframe

The RapidFrame feature, eliminating blurry artifacts and ghosting in multi-frame image sequences, does not need any user interaction. After starting up, RapidFrame will reach full effectiveness after the display warms up.

Bringing up the OSD menus

Bringing up the OSD menus can be done by:

1. If not already done so, switch on the display as previously described.
2. Illuminate the keys as previously described.
3. While the keys are illuminated, touch the key.

As a result, the OSD main menu comes up in the center of the screen. However, if no further actions are taken within the following 30 seconds, the OSD will disappear again

The OSD menu auto-exit function can be disabled in the OSD menu. Please refer to **"OSD menu automatic close function"** on page 36 for detailed instructions on how to do this.

The OSD menu position can be modified in the OSD menu. Please refer to **"OSD menu position"** on page 35 for detailed instructions on how to do this.

Navigating through the OSD menus

Navigating through the OSD menus can be done by:

- Use the and keys to move through the (sub)menus, change values or make selections.
- To go into a submenu or confirm adjustments and selections, use the key.
- Use the key to cancel adjustments or exit a (sub)menu.
- Exit all OSD menus at once by touching the key for approximately 2 seconds.

I-Luminate is not available while the OSD menu is activated.

Advanced operation

OSD menu position

About the OSD menu position

By default, the OSD menu comes up in the bottom center position of the screen. This position can be modified however. There's choice from a number of predefined positions.

To change the position of the OSD menu:

1. Bring up the OSD main menu.
2. Navigate to the **Configuration** > **User Interface** > **Menu** menu.
3. Enter the **Position** submenu.
4. Select one of the available OSD menu positions and confirm.

OSD menu language

About the OSD menu language

By default, the OSD menu comes up in English. However, there's a wide range of other languages available for the OSD menu of your Mammo Tomosynthesis Display.

To change the language of the OSD menu:

1. Bring up the OSD main menu.
2. Navigate to the **Configuration** > **User Interface** > **Menu** menu.
3. Enter the **Language** submenu.
4. Select one of the available languages and confirm.

OSD menu automatic close function

About the OSD menu automatic close function

By default, the OSD menu will disappear automatically after approximately 90 seconds of inactivity. However, this function can be disabled so that the OSD menu remains on the screen until manually closed.

To enable/disable the OSD menu automatic close function:

1. Bring up the OSD main menu.
2. Navigate to the **Configuration** > **User Interface** > **Menu** menu.
3. Enter the **Automatic Close** submenu.
4. Select **Enabled/Disabled** as desired and confirm.

Power status indicator light

About the power status indicator light

By default, when the display is switched on, the power status indicator light is dimmed. This behavior can be changed so that the power status indicator light will be blue when the display is switched on.

> When the display is in stand-by mode, the power status indicator light will always turn orange, even when the power status indicator light is disabled.

To enable/disable the power status indicator light:

1. Bring up the OSD main menu.
2. Navigate to the **Configuration** > **User Interface** > **Indicator Lights** menu.
3. Enter the **Power Status** submenu.
4. Select **Enabled/Disabled** as desired and confirm.

Keys indicator lights

About the keys indicator lights

By default, after lighting up, the keys indicator lights will dim again if no further actions are taken within the following 5 seconds. However, this behavior can be changed so that the keys indicator lights are always on or always off.

To configure the keys indicator lights:

1. Bring up the OSD main menu.
2. Navigate to the **Configuration** > **User Interface** > **Indicator Lights** menu.
3. Enter the **Keys** submenu.
4. Select **Automatic/Always On/Always Off** as desired and confirm.

Power lock function

About the power lock function

By enabling the power lock function, the Mammo Tomosynthesis Display is forced to remain switched on. This means that it can't be switched to stand-by mode until the power lock function is disabled again.

To enable/disable the power lock function:

1. Bring up the OSD main menu.
2. Navigate to the **Configuration** > **User Interface** > **Controls** menu.
3. Enter the **Power Lock** submenu.
4. Select **Enabled/Disabled** as desired and confirm.

DPMS mode

About DPMS mode

Enabling the Display Power Management System (DPMS) mode on your display will optimize its diagnostic lifetime by automatically switching off the backlight when the display is not used for a specified period of time. By default, DPMS mode is enabled on your display, but it also needs to be activated on your workstation. To do this, go to the "Power options properties" window of your workstation.

Barco recommends setting DPMS activation after 20 minutes of non-usage.

To enable/disable DPMS mode on your display:

1. Bring up the OSD main menu.
2. Navigate to the **Configuration** > **Power** menu.
3. Enter the **DPMS Mode** submenu.
4. Select **Enabled/Disabled** as desired and confirm.

I-Luminate default mode

About the I-Luminate default mode

The I-Luminate mode defines the default activated mode during the I-Luminate boost. This mode can be:

Screen	The boost mode is applied on the screen display.
Film (large or small)	Film (large or small): the boost mode activates a high illuminated rectangle on top of the screen, simulating a light box for use with radiological film. The size of this rectangle is similar to a classic (large or small) radiological film.

To set the I-Luminate mode:

1. Bring up the OSD main menu.
2. Navigate to the **Configuration** > **I-Luminate** menu.
3. Enter the **Default mode** submenu.
4. Select **Screen/Small Film/Large Film** as desired and confirm.

I-Luminate film position

About the I-Luminate film position

By default, the I-Luminate rectangle comes up in the top/center of the screen. This position can be changed to top/left or top/right corner.

To set the I-Luminate film position:

1. Bring up the OSD main menu.
2. Navigate to the **Configuration** > **I-Luminate** menu.
3. Enter the **Film Position** submenu.
4. Select **Left/Center/Right** as desired and confirm.

Luminance target

About the luminance target

The luminance target of your Mammo Tomosynthesis Display is adjustable over a predefined range. When you change the luminance target, the display will adjust its backlight to reach the target.

To set the luminance target:

1. Bring up the OSD main menu.
2. Navigate to the **Configuration** > **Calibration** menu.
3. Enter the **Luminance Target** submenu.
4. Set a luminance target value as desired and confirm.

The default value is 1000 cd/m2. The five year warranty is valid for this setting.

Viewing modes

About viewing modes

The Mammo Tomosynthesis Display can be used in two viewing modes:

Diagnostic	This mode provides the full calibrated luminance and is intended for using the display for diagnostic purposes.
Text	In this mode, the luminance is reduced to approximately half of the luminance. This is intended for using the display with office applications such as word processing.

As the Mammo Tomosynthesis Display is intended to be used in a diagnostic environment, the diagnostic mode should always be selected.

To select a viewing mode:

1. Bring up the OSD main menu.
2. Navigate to the **Configuration** > **Calibration** menu.
3. Enter the **Viewing Mode** submenu.
4. Select **Diagnostic/Text** as desired and confirm.

Display functions

About display functions

Native, uncorrected panels will display all grayscale/color levels at an equal luminance. Studies have shown however, that in medical images certain grayscale/color parts contain more diagnostic information then others. To respond to these conclusions, display functions have been

defined. These functions emphasize on these parts containing crucial diagnostic information by correcting the native panel behavior.

Native	If you select Native, the native panel behavior will not be corrected.
Dynamic Gamma 1.8 **Dynamic Gamma 2.2**	These are gamma functions that are shifted to take into account the non-zero luminance of an LCD panel when driven with a "black" signal. They are especially useful in CT applications to improve the perception of low Haunsfield values.
DICOM	DICOM (Digital Imaging and Communications in Medicine) is an international standard that was developed to improve the quality and communication of digital images in radiology. In short, the DICOM display function results in more visible grayscales in the images. Barco recommends selecting the DICOM display function for most medical viewing applications.
User	This display function will be automatically selected when display functions are defined by MediCal QAWeb.
Gamma 1.8 **Gamma 2.2**	Select one of these display functions in case the display is to replace a CRT display with a gamma of 1.8 or 2.2 respectively.

To select a display function:

1. Bring up the OSD main menu.
2. Navigate to the **Configuration** > **Calibration** menu.
3. Enter the **Display Function** submenu.
4. Select one of the available display functions and confirm.

Ambient Light Compensation (ALC)

About ALC

> Ambient Light Compensation (ALC) can only be enabled on your display when the DICOM display function is selected. Therefore, please refer to **"Display functions"** on page 41 to correctly set the display function.

When ALC is enabled, the DICOM display function will be recalculated taking a preset ambient light correction value into account. This value is determined by the selected reading room. Therefore, it is also important to select a realistic reading room when enabling ALC. This can be done by following the instructions in **"Reading rooms"** on page 43.

To enable/disable ALC:

1. Bring up the OSD main menu.
2. Navigate to the **Configuration** > **Calibration > Ambient Light** menu.
3. Enter the **Ambient Light Compensation** submenu.
4. Select **Enabled/Disabled** as desired and confirm.

Reading rooms

About reading rooms

> Reading rooms can only be selected when the DICOM display function is selected. Therefore, please refer to **"Display functions"** on page 41 to correctly set the display function.

The American Association of Physicists in Medicine (AAPM) composed a list of pre-defined reading rooms. Each of these reading rooms are defined by following parameters:

- the maximum light allowed in this type of room
- the preset ambient light correction value for this reading room

These parameters are stored in your display and determine the preset ambient light correction value to take into account to recalculate the DICOM display function when Ambient Light Compensation (ALC) is enabled. Please refer to **"Ambient Light Compensation (ALC)"** on page 43 to enable ALC.

The available reading rooms for your MAMMO TOMOSYNTHESIS Display are:

CR/DR/MAMMO	Corresponds to light conditions in diagnostic reading rooms for computed radiology, digital radiology or mammography. This setting has the lowest maximum ambient light.
CT/MR/NM	Corresponds to light conditions in diagnostic reading rooms for computed tomography, magnetic resonance or nuclear medicine scans.
Staff Office	Corresponds to light conditions in office rooms.
Clinical Viewing Room	Corresponds to light conditions in diagnostic reading rooms for clinical viewing.
Emergency Room	Corresponds to light conditions in emergency rooms.
Operating Room	Corresponds to light conditions in operating rooms. This setting has the highest maximum ambient light.

TO SELECT A READING ROOM:

1. Bring up the OSD main menu.
2. Navigate to the **Configuration** > **Calibration > Ambient Light** menu.
3. Enter the **Reading Room** submenu.
4. Select one of the available reading rooms and confirm.

Image orientation

About image orientation

Your Mammo Tomosynthesis Display does not support landscape orientation. Therefore this setting must always be the default factory setting (portrait).

Image scaling

About image scaling

Enabling image scaling will multiply each individual pixel to one or more adjacent pixels so that the size of the displayed image will be a multiple of the original image source video input signal.

> Image scaling is only possible when the resolution of your display's video input signal is less than or equal to half the maximum resolution of the display.

To enable/disable image scaling:

1. Bring up the OSD main menu.
2. Navigate to the **Configuration** > **Image Source** menu.
3. Enter the **Scaling** submenu.
4. Select **Enabled/Disabled** as desired and confirm.

Video input signals

About input signals

The available input signals for your display are:

DisplayPort 1	The input corresponding to the DisplayPort connector.
DVI 1	The input corresponding to the DVI connector.
Automatic Selection	The input is automatically selected.

To manually select a video input signal:

1. Bring up the OSD main menu.
2. Navigate to the **Configuration** > **Image Source** menu.
3. Enter the **Input Signal** submenu.
4. Select one of the available input signals and confirm.

Video encoding modes

About video encoding modes

Video encoding modes specify how the color and luminance information is encoded in the video signal. In consumer displays, this is usually done by a limited 8-bit encoding mechanism. Your Mammo Tomosynthesis Display however, features 10-bit encoding enabling it to better match the DICOM defined grayscale range. Such an extensive range is necessary to comply with the guidelines set forward by the latest medical guidelines.

The available video encoding modes for your display are listed below.

Please note that the display controller connected to your display might not always support all these video encoding modes.

Standard	This mode uses the standard 8 bit encoding mechanism.
HDR1	This mode features 10-bit video encoding following the High Dynamic Range (HDR) standard, usually used on color displays.
HDR2	HDR2 is a Barco specific mode featuring 10-bit video encoding following the High Dynamic Range (HDR) standard but allowing full refresh rate (which is not always possible with HDR1). This mode is usually used on color displays.
Dual 10	Dual 10 is a Barco specific 10-bit video encoding mode which is usually used on grayscale displays and which allows full refresh rate.
Automatic	When selecting this option, your Mammo Tomosynthesis Display will automatically assign the correct video encoding settings to the connected video input signals.

To manually select a video encoding mode:

1. Bring up the OSD main menu.
2. Navigate to the **Configuration** > **Image Source** menu.
3. Enter the **Video Encoding** submenu.
4. Select one of the available video encoding modes and confirm.

Grayscale conversion modes

About grayscale conversion modes

Grayscale conversion modes specify how color generated on the display controller is converted to grayscale in your display.

The available grayscale conversion modes are:

Use Red Channel	This mode is intended for grayscale displays where gray is sent over the red channel.
Use Green Channel	This mode is intended for grayscale displays where gray is sent over the green channel.
Use Blue Channel	This mode is intended for grayscale displays where gray is sent over the blue channel.
Use All Channels	This mode is intended for grayscale displays where gray is sent over the red, green and blue channel. This done by means of a standard conversion mechanism where 30% red, 59% green and 11% blue are used to generate gray.

To manually select a grayscale conversion mode:

1. Bring up the OSD main menu.
2. Navigate to the **Configuration** > **Image Source** menu.
3. Enter the **Grayscale Conversion** submenu.
4. Select one of the available color conversion modes and confirm.

Video timings

About video timings

Following video timings are available for your Mammo Tomosynthesis Display:

Refresh Rate	Allows to manually select the refresh rate of the image source video input signal depending on the maximum refresh rate of the display controller connected to your display.
Orientation	Allows to change the orientation of the image source video input signal to landscape, portrait or to let the display automatically assign the correct orientation.

To manually set video timings:

1. Bring up the OSD main menu.
2. Navigate to the **Configuration** > **Image Source** menu.
3. Enter the **Timings** submenu.
4. Select **Refresh Rate** or **Orientation**.
5. Select one of the available settings and confirm.

Display info

About display info

Your display serial number, color type, native resolution, firmware versions, etc. are available in a dedicated submenu of the OSD menu.

To retrieve info about your display:

1. Bring up the OSD main menu.
2. Navigate to the **About this Display** menu.
3. Enter the **Display** or **Firmware** submenu as desired.

Display status

About display status

The Status submenu of the OSD menu provides info on the current status of your display (runtimes, temperatures, etc.), the status of the connected image sources (video encoding mode, timings, etc.) and the current calibration status of your display (display function, luminance, ALC, etc.).

To retrieve the status of your display:

1. Bring up the OSD main menu.
2. Navigate to the **Status** menu.
3. Enter the **Display**, **Image Source** or **Calibration** submenu as desired.

Maintenance

The Mammo Tomosynthesis Display does not require any scheduled maintenance activities. In case of a defect, return the display to a Barco approved maintenance organization. In any case of doubts, contact the Barco Medical Imaging Division.

Remove both displays from the dual tilt & swivel foot and apply the tilt & swivel lock before transportation.

Before removing a display from the foot make sure that the tilt position is fully up. This to prevent damage when the tilt spring mechanism is released from the weight of the display!

Cleaning instructions

Front glass

Clean the front glass using a sponge, cleaning cloth or soft tissue, **lightly** moistened with one of the following tested products:

- Flux
- Windex Glass Plus
- Bohle glass cleaner
- Mr. Proper
- Pril
- Ajax glass cleaner
- Sidolin glass cleaner
- 25% ethanol solution (EtOH)

In case none of the above cleaning products is available, use plain water.

⚠ Take care not to damage or scratch the front glass. Be careful with rings or other jewelry and do not apply excessive pressure on the front glass.

⚠ Do not apply or spray liquid directly to the front glass as excess liquid may cause damage to internal electronics. Instead, apply the liquid to the cleaning cloth.

⚠ Do not use following products:

- Alcohol/solvents at higher concentration > 5%
- Strong alkalis lye, strong solvents
- Acid
- Detergents with fluoride
- Detergents with ammonia
- Detergents with abrasives
- Steel wool
- Sponge with abrasives
- Steel blades
- Cloth with steel thread

Cabinet

1. Clean the cabinet using a soft cotton cloth, **lightly** moistened with a recognized cleaning product for medical equipment.

   The cabinet has been tested for resistance to the following products:

   - Cidex, Betadine
   - Alcohol (Isopropyl and Ethyl)
   - Ammonia-based cleaners (Windex)
   - Aquasonic Gel

   In case none of the above cleaning products is available, use plain water.

   > ⚠ Do not apply or spray liquid directly to the cabinet as excess liquid may cause damage to internal electronics. Instead, apply the liquid to the cleaning cloth.

2. Repeat with water only.
3. Wipe dry with a dry cloth.

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Important information

Safety instructions

General Recommendations

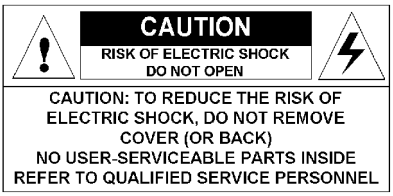
Read the safety and operating instructions before operating the display.

Retain safety and operating instructions for future reference.

Adhere to all warnings on the display and in the operating instructions manual.

Follow all instructions for operation and use.

Electrical shock



Type of protection (electrical):

Display with external power supply: Class I equipment

Degree of safety (flammable anesthetic mixture):

Equipment not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.

Non-patient care equipment

Equipment primarily for use in a health care facility that is intended for use where contact with a patient is unlikely.

Power connection - display with external 24 VDC power supply

- Power requirements: The display must be powered using the delivered medical approved 24 VDC SELV power supply.
- The medical approved DC power supply must be powered by the AC mains voltage (protective earth terminal).

Power cords:

- Utilize a UL-listed detachable power cord, 3-wire, type SJ or equivalent, 18 AWG min., rated 300 V min., provided with a hospital-grade type plug 5-15P configuration for 120V application, or 6-15P for 240V application.
- Do not overload wall outlets and extension cords as this may result in fire or electric shock.
- Mains lead protection (U.S.: Power cord): Power cords should be routed so that they are not likely to be walked upon or pinched by items placed upon or against them, paying particular attention to cords at plugs and receptacles.

Water and moisture

Never expose the display to rain or moisture.

Never use the display near water - e.g. near a bathtub, washbasin, swimming pool, kitchen sink, laundry tub or in a wet basement.

Ventilation

Do not cover or block the ventilation openings in the cover of the set. When installing the display in a cupboard or another closed location, heed the necessary space between the set and the sides of the cupboard.

Installation

Place the display on a flat, solid and stable surface that can support the weight of at least 3 displays. If you use an unstable cart or stand, the

display may fall, causing serious injury to a child or adult, and serious damage to the equipment.

This apparatus conforms to:

CE0120 (MDD 93/42/EEC class IIb product), CE - 2004/108/EC, CE - 93/42/EEC; A1:2007/47/EC class II b, UL 60601-1 1ST EDITION, CAN/CSA-C22.2 NO. 601.1-M90, IEC 60601-1 2ND ED:1988 + A1:1991 + A2:1995, IEC 60950-1:2005 2ND EDITION, DEMKO - EN 60601-1, CCC - GB9254-2008 + GB4943-2001 + GB17625.1-2003, VCCI, FCC class B, BSMI, FDA 510K, RoHS, KC

National Scandinavian Deviations for Cl. 1.7.2:

Finland: "Laite on liitettävä suojamaadoituskoskettimilla varustettuun pistorasiaan"
Norway: "Apparatet må tilkoples jordet stikkontakt"
Sweden: "Apparaten skall anslutas till jordat uttag"

Environmental information

Disposal information (Waste Electrical and Electronic Equipment)

This symbol on the product indicates that, under European Directive 2002/96/EC governing waste from electrical and electronic equipment, this product must not be disposed of with other municipal waste. Please dispose of your waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources.

For more information about recycling of this product, please contact your local city office, your municipal waste disposal service or the shop where you purchased the product.

Mercury notice

This Barco product consists of materials that may contain mercury, which must be recycled or disposed of in accordance with local, state, or country laws:

- Within this system, the backlight lamps in the monitor display contain mercury

Turkey RoHS compliance

Republic of Turkey: In conformity with the EEE Regulation
Türkiye Cumhuriyeti: EEE Yönetmeliğine Uygundur

中国大陆 RoHS (Chinese Mainland RoHS)

根据中国大陆《电子信息产品污染控制管理办法》（也称为中国大陆 RoHS），以下部分列出了 Barco 产品中可能包含的有毒和 / 或有害物质的名称和含量。中国大陆 RoHS 指令包含在中国信息产业部 MCV 标准：“电子信息产品中有毒物质的限量要求” 中。

According to the "China Administration on Control of Pollution Caused by Electronic Information Products" (Also called RoHS of Chinese Mainland), the table below lists the names and contents of toxic and/or hazardous substances that Barco's product may contain. The RoHS of Chinese Mainland is included in the MCV standard of the Ministry of Information Industry of China, in the section "Limit Requirements of toxic substances in Electronic Information Products".

零件项目 (名称) Component Name	有毒有害物质或元素 Hazardous Substances or Elements					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr6+)	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
印制电路配件 Printed Circuit Assemblies	X	0	0	0	0	0
液晶面板 LCD panel	X	X	0	0	0	0
外接电 (线) 缆 External cables	X	0	0	0	0	0
内部线路 Internal wiring	0	0	0	0	0	0
金属外壳 Metal enclosure	0	0	0	0	0	0
塑胶外壳 Plastic enclosure	0	0	0	0	0	0
散热片 (器) Heatsinks	0	0	0	0	0	0
风扇 Fan	0	0	0	0	0	0

电源供应器 Power supply unit	X	0	0	0	0	0
文件说明书 Paper manuals	0	0	0	0	0	0
光盘说明书 CD manual	0	0	0	0	0	0

O: 表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T 11363-2006 标准规定的限量要求以下 .
O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.

X: 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T 11363-2006 标准规定的限量要求 .
X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T11363 2006.

在中国大陆销售的相应电子信息产品（EIP）都必须遵照中国大陆《电子信息产品污染控制标识要求》标准贴上环保使用期限（EFUP）标签。Barco 产品所采用的 EFUP 标签（请参阅实例，徽标内部的编号使用于制定产品）基于中国大陆的《电子信息产品环保使用期限通则》标准。

All Electronic Information Products (EIP) that are sold within Chinese Mainland must comply with the "Electronic Information Products Pollution Control Labeling Standard" of Chinese Mainland, marked with the Environmental Friendly Use Period (EFUP) logo. The number inside the EFUP logo that Barco uses (please refer to the photo) is based on the "Standard of Electronic Information Products Environmental Friendly Use Period" of Chinese Mainland.

Regulatory compliance information

Indications for use

The Mammo Tomosynthesis Display (MDMG-5221) device is intended to be used in displaying and viewing digital images, including standard and multi-frame digital mammography, for review, analysis, and diagnosis by trained medical practitioners. It is specially designed for breast tomosynthesis applications.

CAUTION: Federal law restricts this device to sale by or on the order of a physician. (Details & exemptions are in the Code of Federal Regulations Title 21, 801 Part D)

FCC Class B

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Canadian notice

This Class B digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la Classe B est conforme à la norme NMB-003 du Canada.

Explanation of symbols

On the display or power supply, you may find the following symbols (nonrestrictive list):

CE 0120	Indicates compliance to the essential requirements of the Directive 93/42/EEC
FC	Indicates compliance with Part 15 of the FCC rules (Class A or Class B)
UL or CLASSIFIED UL	Indicates the display is approved according to the UL regulations
c UL us or CLASSIFIED c UL us	Indicates the display is approved according to the c-UL regulations
D	Indicates the display is approved according to the DEMKO regulations
CCC	Indicates the display is approved according to the CCC regulations
VCCI	Indicates the display is approved according to the VCCI regulations
	Indicates the USB connectors on the display
	Indicates the manufacturing date
15 35	Indicates the temperature limitations for the display to operate within specs
SN	Indicates the display serial no.

	Consult the operating instructions
	Indicates this apparatus must not be thrown in the trash but must be recycled, according to the European WEEE (Waste Electrical and Electronic Equipment) directive

Technical specifications

Product Acronym	MDMG-5221
Screen technology	TFT AM LCD Dual Domain IPS
Active screen size (diagonal)	540.9 mm (21.3”)
Active screen size (H x V)	377.9 x 422.4 mm (14.9 x 16.6”)
Aspect ratio (H:V)	4:5
Resolution	5MP (2048 x 2560)
Pixel pitch	0.165 mm
Color imaging	No
Gray imaging	Yes
Number of grayscales (LUT in/LUT out)	1024 grey levels (10/12)
Viewing angle (H, V)	170°
Uniform Luminance Technology (ULT)	Yes
Per Pixel Uniformity (PPU)	Yes
Ambient Light Compensation (ALC)	Yes
Backlight Output Stabilization (BLOS)	Yes
I-Guard	Yes
Maximum luminance	2100 cd/m² typical
DICOM calibrated luminance (ULT off)	1000 cd/m²
Contrast ratio (ULT off)	950:1 typical
Response time (Tr + Tf)	30 ms typical
Scanning frequency (H; V)	30-150 kHz; 15-80 Hz (TBD)

Housing color	Gray
Video input signals	DVI-D / DisplayPort (per display)
Video inout terminals	NA
USB ports	1 upstream (endpoint), 3 downstream
USB standard	2.0
Power requirements (nominal)	100-240V
Power consumption (nominal)	125W
Power save mode	Yes
Power management	DVI-DMPM / DP-DMPM
Dot clock	280 MHz
OSD languages	English, German, French, Dutch, Spanish, Italian, Portuguese, Polish, Russian, Swedish, Chinese (simplified), Japanese, Korean, Arabic
Dimensions with stand (W x H x D)	NA
Dimensions w/o stand (W x H x D)	Portrait: 392 x 484 x 122 mm Landscape: NA
Dimensions packaged (W x H x D)	780 x 550 x 261mm
Net weight with stand	NA
Net weight w/o stand	10.9 kg
Net weight packaged with stand	NA
Net weight packaged w/o stand	17.3 kg
Height adjustment range	100 mm
Tilt	-5° / +30°
Swivel	-45° / +45°

Pivot	90°
Mounting standard	VESA (100 mm)
Screen protection	Protective, non-reflective glass cover
Recommended modalities	Mammography, Breast Tomosynthesis, CT, MR, US, DR, CR, NM, Film
Certifications	CE0120 (MDD 93/42/EEC class IIb product), CE - 2004/108/EC, CE - 93/42/EEC; A1:2007/47/EC class II b, UL 60601-1 1ST EDITION, CAN/CSA-C22.2 NO. 601.1-M90 2005, IEC 60601-1 2ND ED:1988 + A1:1991 + A2:1995, IEC 60950-1:2005 2ND EDITION, DEMKO - EN 60601-1:1990 + A1:1993 + A2:1995, CCC - GB9254-2008 + GB4943-2001 + GB17625.1-2003, VCCI, FCC class B, BSMI, FDA 510K, RoHS, KC
Supplied accessories	User Guide Quick-Installation Sheet Video cables (2 x DisplayPort) Two sets of main cables (UK, European (CEBEC/KEMA), USA (UL/CSA; adaptor plug NEMA 5-15P), Chinese (CCC)) Two USB 2.0 cables Two external power supplies Film clip Keybaord light
Optional accessories	Additional film clip (V622784) Additional keyboard light (B4100574)
QA software	MediCal QAWeb
Unit per pallet	NA
Pallet dimensions	NA
Warranty	5 years
Operating Temperature	0°C to 40°C, 20°C to 30°C within specs
Storage Temperature	-20°C to 60°C
Humidity	90 % (0°C to 40°C)
Altitude	Storage: 7500 m Operational: 3000 m

Legal disclaimer

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Warranty statement

BARCO MID GENERAL WARRANTY TERMS AND CONDITIONS

Applicable from Jan 1st 2008

ARTICLE 1: PRODUCT WARRANTY

Barco nv, Medical Imaging Division warrants that the equipment will be free of defects in workmanship or material for the warranty period or the specific period of a warranty extension program.

Hardware: Barco warrants that upon delivery hereunder the Products shall (i) conform to its specifications in effect at the date of delivery and (ii) be free from defects in material and workmanship (the "Warranties").

Software: Barco warrants that software written by Barco shall perform substantially in accordance with the specifications in effect at the date of delivery. Software is inherently susceptible to bugs and errors. Barco makes no warranties with respect to the software which is provided to Customer on an "as-is" basis and does not warrant uninterrupted or error-free operation of the Products.

Unless otherwise indicated in Barco's Product manual or in the agreement between Barco and Customer, the Warranty Period shall be

(a) Hardware: 12 months commencing on the Barco date of invoice.

(b) Software: 3 months commencing on the Barco date of invoice.

Notwithstanding the provisions of clause 2, repair and replacement of defects in material and/or workmanship under this warranty shall be accomplished in our works according to the terms and conditions as set forth hereafter:

1.1 Any claim under the Warranties must be notified to Barco in writing within 8 days from the date the defect or failure has been discovered or noticed the first time. The Customer, upon the occurrence of any equipment failure, shall contact Barco nv, MID customer support centre (or an authorised service centre) by telephone, fax or e-mail and shall provide the applicable customer support person with a complete description of the problem being encountered, including the model and serial number of the equipment in which the problem has arisen.

1.2 The customer support person shall diagnose the problem experienced by the Customer and shall advise the Customer on how to proceed. Customer support may ask to return the faulty equipment or faulty subassemblies to the Barco nv, or a MID customer support centre (or an authorised service centre) for repair activities. In no event shall Customer return a defective Product or part thereof to Barco without Barco's prior written approval.

In the event the return to Barco of the defective Product is authorized by Barco, Barco shall issue to Customer an RMA (Return Material Authorization).

The Customer shall apply for an RMA number to the closest Barco nv, MID Customer support centre (or an authorised service centre) as listed at www.barcomedical.com, unless otherwise indicated.

The one-way cost of packing, transport and insurance related to shipping the alleged defective Product or part to Barco for repair or replacement shall be borne by Customer. The one-way cost of packing, transport and insurance related to shipping of the repaired or replacement Product or part to Customer shall be borne by Barco.

1.3 The Customer shall return, freight prepaid, the defective equipment or subassemblies in its original packaging with the assigned RMA number for repair to the Barco nv, MID Customer support centre (or an authorised service centre).

1.4 Replacement parts used shall be new or equivalent to new parts for the revision level of the equipment. A replacement LCD panel will be new or similar run time. The warranty period for the replacement parts will expire at the same moment as the original warranty period of the equipment. All parts replaced hereunder and returned to Barco nv, MID (or an authorised service centre) shall become the property of Barco nv, MID (or the authorised service centre).

1.5 The repaired equipment shall be returned to the Customer, by regular freight, at Barco nv, MID's charge.

1.6 Barco nv, MID will replace a product that fails within 90 days after shipment from Barco with a new one, ensuring color matching in the event of a diagnostic multi head display configuration.

Barco aims to ship the new replacement product within 2 business days after receipt of the Customers notification in writing.

ARTICLE 2: CONDITIONS PRECEDENT FOR WARRANTY AND ITEMS EXCLUDED FROM WARRANTY

A. The Warranties shall apply only to the extent the Products or any parts thereof have

(i) been transported and stored at all times in the original packaging in the conditions as specified by Barco (such as covered and secure location, minimum and maximum temperature, maximum humidity, ...) or, in absence thereof, at least in conditions consistent with generally accepted practice for this type of products;

(ii) been handled at all times in accordance with Barco's instructions or, in absence thereof, at least with the care and caution consistent with generally accepted practice for this type of products;

(ii i)been installed strictly in accordance with the instructions and directions given by Barco (if and to the extent the

Products have not been installed by Barco or its authorized subcontractors);

(iv) not been subject to any unauthorized access, alteration, modification or repair or attempts thereto;

(v) been at all times "normally used" for the intended purpose and operated in strict accordance with the operating instructions set forth in the operating manual of the Product in question and shall not have been otherwise misused, abused, damaged. For the purpose hereof, "normally used" shall mean a regular, ordinary and routine usage of the Product in question as intended and/or recommended by Barco;

(vi) been maintained at all times in accordance with Barco's instructions or, in absence thereof, at least with intervals and in a manner consistent with generally accepted practice for this type of products;

B. The warranty described herein shall not include the following:

2.1 Any hardware or software item procured from a source other than Barco nv, MID or their official agent or distributor and integrated by Customer or a third party into Barco nv, MID supplied equipment.

2.2 Any host configuration not explicitly supported by Barco nv, MID.

2.3 All software installed on the system, whether they are acquired from Barco nv, MID or third party. An exception is made for software delivered by Barco nv, MID that would prove to be a cause for the mal functioning of the hardware covered under this Agreement.

2.4 Normal wear and tear, use under circumstances exceeding specifications, such as use in dusty environment or under excessive temperature conditions, abuse, unauthorised repair or alternation, lack of proper configuration or maintenance, damaged or modified or removed serial number, cosmetic refurbishment.

2.5 Repair or replacement of consumables[1] or specific parts that by definition are subject to wear and tear, including but not limited to:

a. CRT's, LCD panels

b. Backlights in diagnostic LCD displays, when the backlight run time[2] is beyond the Guaranteed Backlight Lifetime[3] of that model, when used at the Factory Calibrated Luminance[4]

Eg1.

- A display is used at 8 hours/day; ie. +/-2.920hours/year
- The display system is covered with a warranty period of 5 year
- The Guaranteed Backlight Lifetime of that model is 17.000hours.
- The Factory Calibrated Luminance cannot be achieved anymore after 4 year, thus corresponding to +/-11.680hours
- Result: the backlight replacement is performed under warranty

Eg2.

- A display is used at 24 hours/day; ie. 8.760hours/year
- The display system is covered with a warranty program of 5 year
- The Guaranteed Backlight Lifetime of that model is 17.000hours.
- The Factory Calibrated Luminance cannot be achieved anymore after 2.5years, thus corresponding to +/-21.900hours
- Result: the backlight replacement does not make part of the warranty coverage.

(1): 'Consumable' is a part that can be replaced by the user

(2): 'Backlight run time' is the total time that an image (including use of a screen saver) has been applied to the screen; this value can be consulted via the OSD buttons (On Screen Display).

(3): 'Guaranteed Backlight Lifetime' is the number of backlight hours during which a predefined luminance value, ie. the Factory Calibrated Luminance, will be provided by a specific diagnostic display model. This figure is printed on the Warranty certificate of each display or can be requested at your local Barco office.

(4): 'Factory Calibrated Luminance': is the typical luminance value that a specific diagnostic display model is calibrated at during the production process. This figure is printed on the Warranty certificate of each display or can be requested at your local Barco office.

c. Lamps, optical components in projectors

d. Replacement because of:

i. image retention as a result of:

- not correctly using screen saver and/or Display Power Management System (DPMS) as explained in the user manual
- prolonged operation of the display with a static image on the same screen area

ii. a number of missing pixels that is lower than the total allowable number as mentioned in the product specifications.

iii. difference in color temperature that is lower than the total allowable difference as mentioned in the product specifications

iv. difference in color temperature as a result of not using all displays of a multi-head configuration at the same rate.

v. LCD luminance uniformity that is in within the product specifications or luminance uniformity performance that is inherent to LCD technology.

Barco nv, MID does not warrant a minimum life time nor a performance of any of the consumables.

2.6 Replacement of moveable parts such as power cords, remote controls, ...

2.7 Any product disassembly and installation costs at the operation site, travel expenses and travel time to and from the operation site for the personnel in charge of the repair works and transport charges.

2.8 Any failures resulting from an accident, negligence (such as but not limited to removing or deleting system files & licensed software product files), misuse, circuit failure or any change, damage due to fire, water, thunder or lightning, power failure or fluctuation, disruption of communication lines or due to force majeure, or any reason foreign to the equipment.

2.9 Any specific services or procedures, asked for by Customer, related to verification of repaired equipment.

2.10 The evaluation cost in case of a returned product deemed functional is not covered under warranty and will be charged to the Customer, at Barco's sole discretion, based on a case-by-case evaluation.

ARTICLE 3: OBLIGATIONS OF THE CUSTOMER

Customer hereby assumes the following obligations as partial consideration for Barco nv, MID performance of its requirements under the warranty condition; failure by Customer to meet its obligations under this paragraph shall excuse Barco nv, MID's performance hereunder:

3.1 Customer shall not expose Barco nv, MID personnel to any unsafe working conditions.

3.2 Repairs to equipment under warranty resulting from improper maintenance or repair performed by the Customer, or its officers, agents, employees, or representatives, shall be borne by the Customer at its additional cost and expense.

3.3 The Customer is responsible for installing the Barco nv, MID equipment in an environment for which it was intended. If there is an indication that the equipment was used – even temporary – outside its specifications, Barco nv, MID is entitled not to perform warranty repairs and terminate the warranty agreement. Any actions that have been taken by Barco nv, MID in this respect, may be invoiced to the Customer at normal pricing.

ARTICLE 4: REMEDIES UNDER WARRANTY

(a) Hardware: If during the Warranty Period a Product or any part thereof, fails to meet any of the Warranties then, upon Customer's request, Barco shall, at its sole option and cost, promptly and within 20 working days, either: (i) repair or correct the Product or part in question; or (ii) replace the Product or supply part(s) or component(s) according to the terms and conditions contained in article 1. A replacement part shall be at least functionally equivalent to the original part. The replaced Product, parts and/or components shall become the property of Barco and shall, at Barco's request, be returned by Customer to Barco at Barco's cost.

(b) Software: Barco's sole obligation shall be to rectify substantial malfunctions of the software (to the extent technically reasonably possible) by amending the software or supplying an alternative version of the software.

(c) The repair or replacement under the Warranties covers the cost of material and labor.

ARTICLE 5: DISCLAIMER OF WARRANTIES

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ARTICLE 6: LIMITATION OF LIABILITY

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ARTICLE 7: FORCE MAJEURE

Either party shall be released from performance of its obligations under this agreement to the extent, and for so long as, the performance of this agreement is impeded by reason of force majeure. For the purposes of this clause the

expression "force majeure" means, but shall not be limited to, industrial dispute, fire, mobilisation, requisition, embargo, currency transfer prohibitions, insurrection, lack of means of transport, restrictions of the use of energy, and generally any circumstances which are beyond the control of the parties and hinder performance by one party of his obligations.

ARTICLE 8: GENERAL

8.1 Customer acknowledges its understanding that all software and electronic devices, including Barco nv, MID products are subject to possible error, mechanical or electrical failure, and should not be relied upon in inappropriate applications or without proper backup and/or other safety precautions whenever personal injury or property damage may result from failure or error of the product.

8.2 Barco nv, MID shall not be responsible for machine failure and/or its failure to render service or maintenance due to causes beyond its reasonable control.

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The "source code" for a work means the preferred form of the work for making modifications to it. "Object code" means any non-source form of a work.

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